9-16-2016

Educational Policies Committee Program Proposal, College of Agriculture and Applied Sciences, September 16, 2016

Utah State University

Cover/Signature Page – Full Template

Institution Submitting Request: Utah State University
Proposed Title: Bachelor of Science Degree in Climate Science
School or Division or Location: College of Agriculture and Applied Sciences
Department(s) or Area(s) Location: Plants, Soils and Climate
Recommended Classification of Instructional Programs (CIP) Code[1] : 40.0401
Proposed Beginning Date: 01/02/2017
Institutional Board of Trustees' Approval Date: 05/06/16

Proposal Type (check all that apply):

Regents' Agenda Items		
R401-4 and R401-5 Approval by Committee of the Whole		
SECTION NO.		**ITEM**
4.1.1	☐	(AAS) Associate of Applied Science Degree
4.1.2	☐	(AA) Associate of Arts Degree
	☐	(AS) Associate of Science Degree
4.1.3	☐	Specialized Associate Degree
4.1.4	☒	Baccalaureate Degree
4.1.5	☐	K-12 School Personnel Programs
4.1.6	☐	Master's Degree
4.1.7	☐	Doctoral Degree
5.2.2	☐	(CER C) Certificate of Completion
5.2.4	☐	Fast Tracked Certificate

Chief Academic Officer (or Designee) Signature:
I certify that all required institutional approvals have been obtained prior to submitting this request to the Office of the Commissioner.

Signature: **Date:** 06/15/16

Printed Name: Laurens H. Smith

[1] CIP codes must be recommended by the submitting institution. For CIP code classifications, please see http://nces.ed.gov/ipeds/cipcode/Default.aspx?y=55.

Executive Summary
Higher Education Institution
Bachelor of Science Degree in Climate Science
2/29/2016

Program Description

The Climate Science Degree (CSD) program in the Department of Plants, Soils and Climate is focused on understanding the nature and change of the climate system by applying the basic principles of mathematics, physics, and chemistry. The CSD program will train the next generation of global leaders in climate and climate change sciences while promoting a citizenry informed on the science behind the important environmental and hazard issues of the time. This undergraduate degree program emphasizes the scientific study of the behavior of weather and climate, and applications to the important practical problems of climate prediction and weather forecasting for natural resources. The CSD program is unique in that it incorporates fundamental knowledge of physical climate with the emergence of a new and more complete approach, encompassing all components of the climate system—atmosphere, water, and land surface—to gain a comprehensive understanding of climate change.

Role and Mission Fit

As the state's only land-grant institution and home to the State Climate Office, Utah State University is the logical place to combine both climate science research and higher education. Because of the impact of climate variability on every segment of civilization, including food, water, energy, economy and security, climate science is a quintessential land-grant-university issue. The education mission of Climate Science Degree (CSD) program is to provide its undergraduate students with a faculty of experienced and knowledgeable educators who provide current content in a field- and classroom-enriched learning environment. Modern facilities and advanced research provides students with the tools and experience required to make professional contributions to science and humanity. The CSD program will facilitate the Departmental mission in developing innovative learning environments for educating climate scientists and scientifically literate citizens. It distributes knowledge to an audience of peers and citizens through academic literature and diverse professional activities.

Faculty

USU is the logical place to lead the state's first climate undergraduate degree with its wide range of expertise in basic sciences, agriculture, engineering, and natural resources—all essential to the study of climate science and climate's impact on the state's people, resources, and economy. Climate variability and climate change research is happening at USU across a number of departments and colleges, and faculty resource at USU is sufficient to start the coordinated effort in producing a solid curriculum. To facilitate the CSD program, the Plants, Soils and Climate Department is currently recruiting two additional faculty positions to start in Fall 2016, to address primarily two teaching needs: (1) climate dynamics and modeling as it links climate to extreme weather to forecasting, and (2) paleoclimate observation providing an efficient method of covering the Earth's past climate variability. These two additional faculty members will greatly strengthen this proposed degree program.

Market Demand

Modern climate sciences require skills in engineering, programming, and good communication. The proposed degree program will teach these skills with special attention to "big data" and physical processes, which translate into effective problem solving. These skills are in high demand in Utah where high tech industry is a priority. In the 21st century, any organizations who want to improve their climate-resilence and performance often do not have the internal know-how to develop climate impact solutions; as a result, hiring for climate-related majors has grown in a wide variety of industry sectors. Today's financial market takes into account climate model outputs for various timeframes (days to decades). Climate resilence is a new expertise not a single B.S. program has possesed yet. USU graduates from the CSD program can help companies or governments identify their key climate related challenges, after which he/she can develop support measures or to attract new solutions. Another type of job market is meteorology-related, both in the public sector (military and the federal government) and the private sector (media, commercial companies, insurance, etc.). Private-sector climatologists work in a variety of environments ranging from consulting businesses to commodity and insurance businesses. The number of private companies that hire meteorologist or climatologist has grown in the past few years. Even oil companies are watching the emerging climate-energy laws and risks[2]. The Utah Department of Workforce services rates atmospheric scientists and similar professionals as having a moderate to strong employment outlook.

Student Demand

Since 2011, faculty teaching climate courses including Drs. Hipps, Gillies, Wang and Jin have been inquired by students about degree programs in climate or climate change. This newly emerged interest in climate-related issues is a welcoming sign that USU students are in-tune with this important global and societal issue. Their interest and inquries also reflect a new trend in academia: Institutions around the nation (and around the world) are either creating or expanding academic programs, research programs, and centers around climate and climate change sciences. The effect of these efforts is to attract faculty, students, and research funds. As of 2014, at least 11 state universities in the U.S. have launched cluster-hires in climate change to meet the demand, but Utah is not one of them.

Statement of Financial Support

Appropriated Fund……	☒
Special Legislative Appropriation……	☐
Grants and Contracts……	☐
Special Fees ……	☐
Differential Tuition (must be approved by the Regents)……..	☐
Other (please describe)……	☐

[2] http://www.climate-policy-watcher.org/?q=node/491

Similar Programs Already Offered in the USHE

USU will be the first in the Intermountain region to offer a BS degree dedicated to climate and climate change sciences. USU's graduate degree in Climate Sciences (established in 2013) sets apart from the more traditional, meteorological focus of atmospheric science departments as it covers not only the physical aspects of climate systems but also the applications of climate sciences. The University of Utah (UU) currently has a Department of Atmospheric Sciences with a teaching focus on weather forecasting and atmospheric physics. In 2013, USU's Climate Sciences graduate program made connection with the UU's Atmospheric Sciences Department and the two have agreed to share common courses, one of which is Advanced Dynamical Meteorology and the other is Matlab programming.

Program Description – Full Template
Higher Education Institution
Bachelor of Science Degree in Climate Science
02/29/2016

Section I: The Request

Utah State University, College of Agriculture and Applied Sciences requests approval to offer Climate Science Bachelor of Science (BS) Degree effective Spring 2017.

Section II: Program Description

Complete Program Description

The Climate Science Degree (CSD) program in the Department of Plants, Soils and Climate is focused on understanding the nature and change of the climate system by applying the basic principles of mathematics, physics, and chemistry. This undergraduate degree emphasizes the scientific study of the behavior of weather and climate, and applications to the important practical problems of climate prediction and weather forecasting for natural resources. The CSD program integrates basic and applied principles of climatology, environmental physics, and meteorology, which are concerned with how natural laws determine the climate. Physical meteorology and land surface physics are also part of climate science because the Earth's climate variability is strongly coupled to the oceans and the land. In addition, interactions between land ecosystems, water and climate are studied. This includes understandings and measurements of the atmosphere, soil, water and plants, and how the data are used to address practical issues related to climate change. The graduates will be well prepared to pursue graduate education in interdisciplinary science programs; they will also be suited for continuing the studies in atmospheric science, climatology, hydrology and most other physical sciences. The skills instilled in the graduates will qualify them as researchers or technicians in federal, state and university laboratories. They will also be qualified to work with private sectors to design and conduct observations and data analyses for tasks related to weather, climate, water, and energy.

The core training of the CSD program focuses on the physical science of the climate system, one that concerns how natural laws determine the climate. As such, the basic curriculum must and will meet the guidelines of the American Meteorological Society (AMS) and the requirements for employment in the National Oceanic and Atmospheric Administration (NOAA) and a variety of consulting and professional meteorological/hydrological services. USU is a member of the University Corporation for Atmospheric Research, a consortium of more than 100 North American member colleges and universities focused on research and training in the atmospheric and related climate system sciences. The CSD program is unique in that it also incorporates fundamental knowledge of physical climate with the emergence of a new and more complete approach, encompassing all components of the climate system—atmosphere, water, and land surface—to gain a comprehensive understanding of climate change.

Purpose of Degree

The CSD program will train the next generation of global leaders in climate system and climate change sciences while promoting a citizenry informed on the science behind the important environmental and hazard issues. The program aims to teach the students about the dynamics and physics of the oceanic

and atmospheric circulations and associated variability across different timescales, with a focus on weather systems, water cycles, and extreme events. Students graduating with a Climate Science Degree will have built a solid foundation in the physical aspects of climate system and climate change, enabling them to pursue specific graduate degrees (either in mitigation or physical research) or work in various sectors.

Climate and climate change studies are among the most rapidly growing topics in research, crossing physical science and social science. These are quintessential interdisciplinary studies, involving not only the physical aspects of earth science, but also the science of climatic impacts to natural systems and humanity, and mitigation of rapid change in natural systems. In Utah, these subjects are facing future planning not only for energy and agriculture, but also for water, soil, economics, recreation, and air pollution. Development in the subjects of climate and climate change will form broad umbrellas under which large and rapidly increasing research funds are being offered and deployed.

Institutions across the nation (and around the world) are creating and/or expanding academic programs, research programs, and research centers around climate and climate change. The net effect of these efforts has attracted faculty, students, and research funds. In 2014 alone, at least 11 major universities in the U.S. have launched cluster-hires of interdisciplinary nature that includes faculty in climate sciences to meet the increased demand. More programs are being established such as those in the University of California systems. Thus, it is timely and necessary for USU to build an organizational framework capable of connecting the many separate but related efforts into focused, coordinated endeavors on a degree program dedicated to climate science. Climate is about systems, and effectively studying complex and interacting systems requires learning through a broad spectrum of disciplines. Consequently, USU needs a basic degree devoted to climate change research and response – A Climate Science Degree program.

Institutional Readiness

Utah State University (USU), as one of the state's major universities and the state's only land-grant institution, is well-positioned to make major moves in this direction. There are a number of faculty already involved in climate science, climate change science, and sustainability — they are comprised of climate scientists and meteorologists, as well as geologists, ecologists, water scientists, soil scientists, sociologists, and engineers. USU also possess a successful Extension program necessary to expand the educational goals of climate sciences to the grassroots level, as well as to respond to critical and emerging climate issues in resources planning with research-based, unbiased information.

Current faculty and curriculum in the Department of Plants, Soils and Climate (PSC) comprise the research, teaching and outreach capacity to build a degree in climate and climate change sciences:

- A Climate Science Master and PhD Degree program was established in 2013
- PSC climate faculty are gaining international research prominence with a strong academic record
- The Utah Climate Center (UCC) has a state mandate for providing climate information to the state and region, and has been more than successful in reaching this goal
- Climate faculty and UCC are part of the strong USU ecology and water centers that can build and broaden a degree program

PSC's climate faculty and climate center are nationally and internationally recognized leader in the research of climate diagnostics, prediction and extreme events, particularly as it pertains to the U.S. West; this facilitates transformation of science into the core curriculum of the Climate Science Degree.

Drawing on the faculty expertise of the Climate Science MS/PhD program, strong foundation of the Utah Climate Center research, PSC's close association with USU's Ecology Center and Water Lab, and the two new climate faculty hires in Spring 2016, the new undergraduate program will provide students with an introduction into the science of climate and climate change. Many of USU students are starting in careers where the rules of climate are changing rapidly, and they need to be better prepared for this change. This proposed program will also attract students with a growing interest in pursuing the next big science that prevails in their generation.

Departmental Faculty

Department Faculty Category	Dept Faculty Headcount – Prior to Program Implementation	Faculty Additions to Support Program	Dept Faculty Headcount at Full Program Implementation
With Doctoral Degrees (Including MFA and other terminal degrees, as specified by the institution)			
Full-time Tenured	25	2	27
Full-time Non-Tenured	0	0	0
Part-time Tenured	0	0	0
Part-time Non-Tenured	0	0	0
With Master's Degrees			
Full-time Tenured	0	0	0
Full-time Non-Tenured	5	0	5
Part-time Tenured	0	0	0
Part-time Non-Tenured	0	0	0
Other			
Full-time Tenured	0	0	0
Full-time Non-Tenured	0	0	0
Part-time Tenured	0	0	0
Part-time Non-Tenured	0	0	0
Total Headcount Faculty in the Department			
Full-time Tenured	25	2	27
Full-time Non-Tenured	5	0	5
Part-time Tenured	0	0	0
Part-time Non-Tenured	0	0	0
Total Department Faculty FTE *(As reported in the most recent A-1/S-11 Institutional Cost Study for "prior to program implementation" and using the A-1/S-11 Cost Study Definition for the projected "at full program implementation.")*	30	2	32

Staff

Academic Advisor: A crucial element of the proposed program is a dedicated academic advisor. Fortunately, USU has this unique structure of Coordinator in the Student Services Center, employing staff serving as Academic Advisor for various departments. Currently, PSC has one dedicated Academic

Advisor whose role is advising incoming students. In the initial years of the program, this Academic Advisor will be able to serve the additional students. If enrollment grows to large numbers in the program, then advising loads will be revisited and an additional advisor may be warranted.

Graduate teaching assistant (TA): Graduate students serving as teaching assistants/lecturers are common in most departments of atmospheric sciences or meteorology, but not in USU. Thus, there is a need to allocate sufficient teaching assistantships that are compatible to research assistantships, i.e. $1,300-1,600 per month per person, to help establish the undergraduate courses in basic meteorology and climate physics. Two fulltime TA will be requested through normal departmental channel based on course and student numbers. Undergraduate teaching fellows will be considered to facilitate this effort.

Library and Information Resources

The institution currently has the needed library resources.

Admission Requirements

Requirements for admission into the CSD program in the College of Agricultural and Applied Sciences (CAAS) are consistent with general University admission requirements (one unit equals one high school year): 4 units of English, 4 units of mathematics, 3 units of natural sciences, 3 units of social studies, and 2 units of foreign language. Students must also meet performance requirements (ACT composite of 20 or higher OR combined SAT score of 950 or higher OR rank in the top one-half of graduating class; transfer students must have a 2.5 (on a 4.0 scale) cumulative grade point average and 2.5 on most recent term of attendance.

In addition to the minimum grade point average (GPA) requirements described in the University Policies, the Climate Science entrance-to-major requirement must also be completed with a minimum grade of C: MATH 1210. This course must be completed by the end of the semester during which the entrance-to-major process is carried out.

Student Advisement

The scope of Climate Science is extremely broad and can be demanding. Students will be assigned to support groups consisting of six students and one faculty member. Support groups will meet 1-2 times per semester over lunch to discuss matters of mutual concern. The faculty member will serve as the faculty advisor for the students in his or her support group. It is common for students enrolled in physical science (like climate system) to need professional counseling to help them deal with academic or personal problems. Professional counseling on the USU campus will be provided by the center for Counseling and Psychological Services. In addition, upper-level climate students and faculty will participate in a USU program to build better high-school-to-university transition opportunities for diverse STEM-interested students – InTech Early Collegiate High School (InTech) and the Academy for Math, Engineering, and Science (AMES) are Title I public charter high schools serving diverse students and that provide rigorous, supportive learning environments that blend high school and the first two years of college to raise high school graduation and postsecondary success. The AMES students are 52% non-white with 44% of students receiving free or reduced lunch and with an even gender balance. In special situations, it may be possible for students to consult with a Counseling and Wellness Services psychologist. The Climate

program will form a Student Progress Committee that reviews academic deficiencies and recommends a remediation plan or dismissal from the program, and to determine an appropriate course of action.

Justification for Graduation Standards and Number of Credits

The design of the Climate Science Degree program curriculum does not require more than 126 credit hours. Minimum requirements for this program are:

Minimum University Requirements				
Total Credits	125		Grade Point Average (most majors require higher GPA)	2.50 GPA
Credits of C- or better	100		Credits of upper-division courses (#3000 or above)	40
Total USU Credits	30		Upper-division USU Credits	20
USU Credits within the Major	15		Credits in Minor (if required)	12
Credits in Major	see below		Credits in American Institutions	3
General Education Requirements	see link		University Studies Depth Requirements	see link
NOTES: highest Math Requirement for this degree is				

External Review and Accreditation

External consultants were not involved in the development of the program. There are already a group of USU faculty involved in climate science, climate change science, resources management and sustainability — they come from climate scientists and meteorologists, as well as geologists, ecologists, water scientists, soil scientists, sociologists, and engineers and are experienced educators.

Projected Program Enrollment and Graduates; Projected Departmental Faculty/Students

Data Category	Current – Prior to New Program Implementation	PROJ YR 1	PROJ YR 2	PROJ YR 3	PROJ YR 4	PROJ YR 5
Data for Proposed Program						
Number of Graduates **in Proposed Program**	X	X	X	5	15	25
Total # of Declared Majors **in Proposed Program**	X	X	5	10	15	25
Departmental Data – For All Programs Within the Department						
Total Department Faculty FTE *(as reported in Faculty table above)*	30	32	34	34	34	34
Total Department Student FTE *(Based on Fall Third Week)*						
Student FTE per Faculty FTE *(ratio of Total Department Faculty FTE and Total Department Student FTE above)*						

Program accreditation-required ratio of Student FTE/Faculty FTE, if applicable: (Provide ratio here:_____)						

Expansion of Existing Program

USU has not had any climate or meteorology undergraduate degree program before.

Section III: Need

Program Need

The recent increases in weather/climate extreme events and the irregular climate variability, together with the broader and connected challenge of global sustainability, are poised to dominate human endeavor and direction this century. The outcome of the 2015 Paris Climate Submit was historical: it concluded with a landmark agreement to curb greenhouse gas emissions around the globe including the United States. The impact of this outcome in the decades to come remains far from certain, and will touch every corner of the world's societies. The new treaty ends the strict differentiation between developed and developing countries that characterized earlier efforts, replacing it with a common framework that commits all countries to put forward their best efforts and to strengthen them in the years ahead. This includes, for the first time, requirements that all parties report regularly on their emissions and implementation efforts, and undergo international review. Therefore, in 10 or 20 years' time it will be up to the next educated generation to provide such complicated information, assessment, and mitigation plans. Utah State University will play a leading role in providing higher education of climate for this new generation.

As Utah's premier and only land-grant institution, USU is the logical place to lead the state in climate research and higher education. With its wide range of expertise in basic sciences, agriculture, engineering, and Extension infrastructure, USU is well positioned to lead regionally in educating the state's young generation in climate and climate change science. While climate variability and climate change research is happening at USU across a number of departments and colleges, these efforts are generally disconnected and few are transferrable into undergraduate education. What is lacking is a dedicated degree program around which expertise and faculty resource can be integrated to bring the cutting-edge science to undergraduate students.

Earth's climate will continue to change; the pace of that change will likely accelerate; and impacts to natural and human systems — already more significant than previously anticipated — will be severe. The simple truth of these statements is manifest in a slew of recent national and international synthesis reports representing a scale of effort unprecedented in science*. Made clear in these reports is that meaningful response to these climate-induced challenges is not likely through incrementalism; transformational change is needed. Higher education provides an effective and necessary means to facilitate such a change.

* See, for example: IPCC Fifth Assessment Report, Working Groups I-III (2014); The National Climate Assessment (2014); Climate Change, Evidence and Causes, An overview from the Royal Society and the US National Academy of Sciences (2014); What We Know: the Reality, Risks, and Response to Climate Change, AAAS (2014);

The purpose of establishing the Climate Science Degree program is to position Utah State University as the base for higher education on climate and climate change for Utah's next-generation citizens. One cannot effectively study climate change science — and all that it entails — without first also learning the climate science. Understanding future impacts to natural and human systems, formulating impact mitigation strategies, and formulating adaptation scenarios all begin with the climate science itself: What is the climate system going to be? Answering this question requires not only faculty and graduate students, but also an education entity that brings the next generation up to speed to this 21st century problem of climate change. The new program's close proximity with (and involvement of) agriculture and soils faculty will contribute to a successful degree program in the sciences of climate change mitigation.

Labor Market Demand

Climate scientists, including meteorologists held about 11,100 jobs in 2012[3]. Employment of climate scientists is projected to grow 10 percent from 2012 to 2022, about as fast as the average for all occupations[2]. New computer models have vastly improved the accuracy and extent of forecasts and allowed climate scientists or meteorologists to tailor climate prediction to specific purposes. This will increase the need for climate scientists working in private industry as businesses demand more specialized weather and climate information. The best job prospects for climate science major are projected to be in private industry[4]. The industries that employed the most climate scientists in 2012 were as follows:

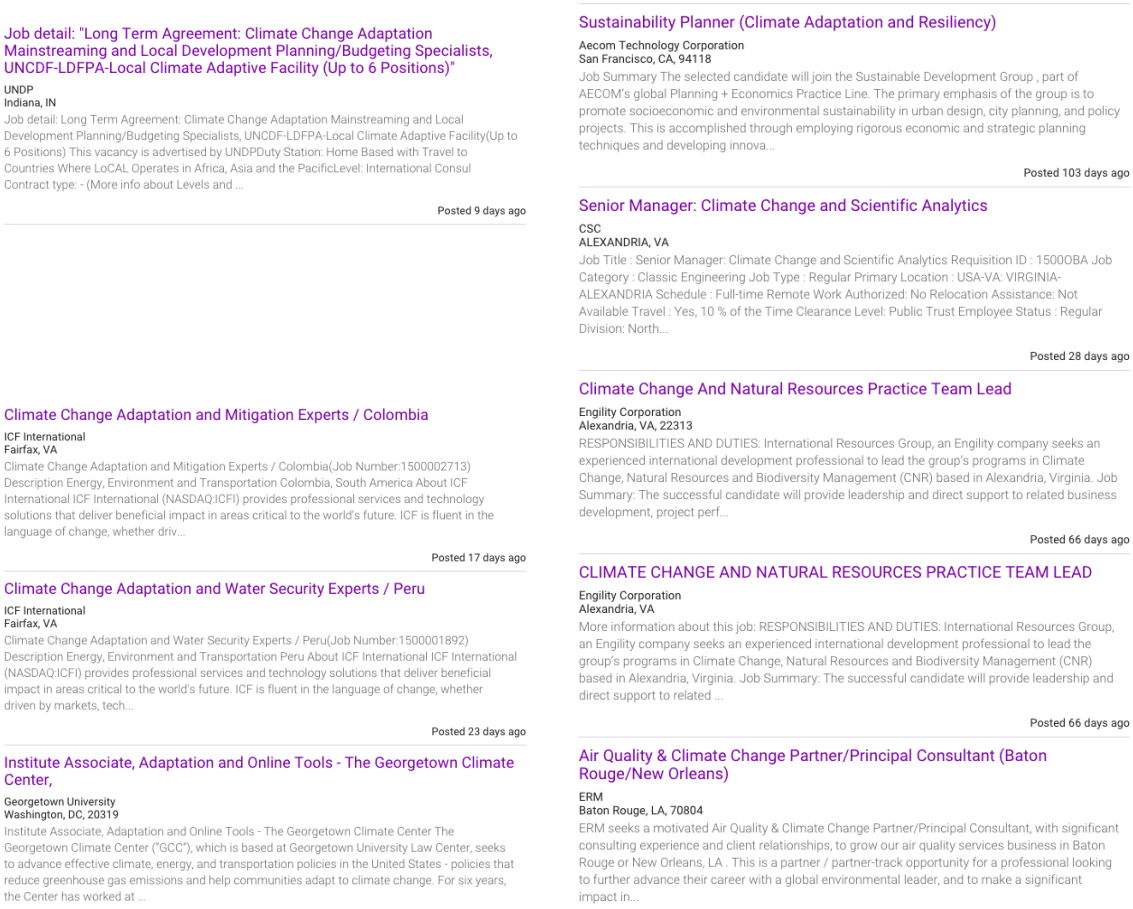
Professional, scientific, and technical services	36%
Federal government, excluding postal service	29%
Colleges, universities, and professional schools; state, local, and private	19%
Radio and television broadcasting	8%

In the federal government, most climate scientists work as weather forecasters with the National Weather Service or Climate Prediction Center of the National Oceanic and Atmospheric Administration (NOAA) in offices throughout the United States, some at airports, in or near cities, and occasionally stationed in critical but remote areas. The Department of Defense, which calls climate change an "immediate risk", employed several hundred climate scientists in 2012. In addition, hundreds of members of the Armed Forces are involved in climate/atmospheric science.

The job market for climate-background personnel has been going through a transformational change, from sections asking people of diverse backgroun to conduct climate-related tasks into companies directly recruting climate scientists or social scientists. Climate scientists involved in research often work in either govenmental or university laboratories. Climate scientists who work in private industry will have to analyze climate change impact on society as a way to formulate insurance policy; this has been on growing demand for the costal regions (hurricanes and sea level rise), the Great Plains (tornado alley), and western states (drought and large fires).

As an exmaple, some recent job postings for climate and climate change fields are provided below (http://jobs.monster.com/v-engineering-q-climate-change-adaptation-jobs.aspx):

[3] https://collegegrad.com/careers/atmospheric-scientists-and-meteorologists
[4] Source: Bureau of Labor Statistics, U.S. Department of Labor.



Job detail: "Long Term Agreement: Climate Change Adaptation Mainstreaming and Local Development Planning/Budgeting Specialists, UNCDF-LDFPA-Local Climate Adaptive Facility (Up to 6 Positions)"

UNDP
Indiana, IN

Job detail: Long Term Agreement: Climate Change Adaptation Mainstreaming and Local Development Planning/Budgeting Specialists, UNCDF-LDFPA-Local Climate Adaptive Facility(Up to 6 Positions) This vacancy is advertised by UNDPDuty Station: Home Based with Travel to Countries Where LoCAL Operates in Africa, Asia and the PacificLevel: International Consul Contract type: - (More info about Levels and ...

Posted 9 days ago

Climate Change Adaptation and Mitigation Experts / Colombia

ICF International
Fairfax, VA

Climate Change Adaptation and Mitigation Experts / Colombia(Job Number:1500002713) Description Energy, Environment and Transportation Colombia, South America About ICF International ICF International (NASDAQ:ICFI) provides professional services and technology solutions that deliver beneficial impact in areas critical to the world's future. ICF is fluent in the language of change, whether driv...

Posted 17 days ago

Climate Change Adaptation and Water Security Experts / Peru

ICF International
Fairfax, VA

Climate Change Adaptation and Water Security Experts / Peru(Job Number:1500001892) Description Energy, Environment and Transportation Peru About ICF International ICF International (NASDAQ:ICFI) provides professional services and technology solutions that deliver beneficial impact in areas critical to the world's future. ICF is fluent in the language of change, whether driven by markets, tech...

Posted 23 days ago

Institute Associate, Adaptation and Online Tools - The Georgetown Climate Center,

Georgetown University
Washington, DC, 20319

Institute Associate, Adaptation and Online Tools - The Georgetown Climate Center The Georgetown Climate Center ("GCC"), which is based at Georgetown University Law Center, seeks to advance effective climate, energy, and transportation policies in the United States - policies that reduce greenhouse gas emissions and help communities adapt to climate change. For six years, the Center has worked at ...

Sustainability Planner (Climate Adaptation and Resiliency)

Aecom Technology Corporation
San Francisco, CA, 94118

Job Summary The selected candidate will join the Sustainable Development Group , part of AECOM's global Planning + Economics Practice Line. The primary emphasis of the group is to promote socioeconomic and environmental sustainability in urban design, city planning, and policy projects. This is accomplished through employing rigorous economic and strategic planning techniques and developing innova...

Posted 103 days ago

Senior Manager: Climate Change and Scientific Analytics

CSC
ALEXANDRIA, VA

Job Title : Senior Manager: Climate Change and Scientific Analytics Requisition ID : 15000BA Job Category : Classic Engineering Job Type : Regular Primary Location : USA-VA: VIRGINIA-ALEXANDRIA Schedule : Full-time Remote Work Authorized: No Relocation Assistance: Not Available Travel : Yes, 10 % of the Time Clearance Level: Public Trust Employee Status : Regular Division: North...

Posted 28 days ago

Climate Change And Natural Resources Practice Team Lead

Engility Corporation
Alexandria, VA, 22313

RESPONSIBILITIES AND DUTIES: International Resources Group, an Engility company seeks an experienced international development professional to lead the group's programs in Climate Change, Natural Resources and Biodiversity Management (CNR) based in Alexandria, Virginia. Job Summary: The successful candidate will provide leadership and direct support to related business development, project perf...

Posted 66 days ago

CLIMATE CHANGE AND NATURAL RESOURCES PRACTICE TEAM LEAD

Engility Corporation
Alexandria, VA

More information about this job: RESPONSIBILITIES AND DUTIES: International Resources Group, an Engility company seeks an experienced international development professional to lead the group's programs in Climate Change, Natural Resources and Biodiversity Management (CNR) based in Alexandria, Virginia. Job Summary: The successful candidate will provide leadership and direct support to related ...

Posted 66 days ago

Air Quality & Climate Change Partner/Principal Consultant (Baton Rouge/New Orleans)

ERM
Baton Rouge, LA, 70804

ERM seeks a motivated Air Quality & Climate Change Partner/Principal Consultant, with significant consulting experience and client relationships, to grow our air quality services business in Baton Rouge or New Orleans, LA . This is a partner / partner-track opportunity for a professional looking to further advance their career with a global environmental leader, and to make a significant impact in...

The National Oceanic and Atmospheric Administration (NOAA) has recently established its Climate Serivce, a comprehensive and integrated office responsible for NOAA's climate science, data, information and services. It provides an integrated governentent entity for users across the nation in much the same way NOAA's National Weather Service has been providing weather information and services for 140 years. Individuals, local and national governments and the private sector are increasingly demanding this information to be able to better understand, adapt to, and plan for a changing climate. The expertise needed for the NOAA Climate Service will include research labs, climate observing systems, modeling facilities, integrated monitoring systems and extensive on the ground service delivery infrastructure. All of these service components are tied into the Climate Science theme the proposed program aims to educate.

Student Demand

Students in and around Utah are consciously aware of the uncertain future of natural and water resources, such as winter snowpack and drought severity. These conditions are sensitive to the changing climate conditions. As impacts of climate change become an inescapable global reality, the field of climate science is more important than ever. Earning a Bachelor of Science is the first step for future students in this field, and increased employment opportunities on environmental impacts by climate change are seen in both government agencies and private sectors.

As of 2014, eleven major universities across the U.S. have launched cluster-hires in climate change to meet the demand. A survey conducted among the department chairs of some newly established climate undergraduate programs indicates a promising student demand:

- School of Earth and Climate Sciences, University of Maine – established for 4 years with around 50 students and an increasing trend in enrollment and an excellent placement rate (contact: Prof. Scott Johnson)
- Climate Science Degree program, University of Nebraska – established for 1.5 year (contact: Prof. John Carroll)
- BS for Climate Science, University of Idaho – established for 2.5 years with 16 students completed (contact: Prof. John Abatzoglou)
- BS in Earth Sciences with a Climate emphasis, San Francisco State University – established less than 1 year with ~24 students enrolled (contact: Prof. Dave Dempsey)

Having taught climate-related classes for the past five years, current climate faculty members (Drs. Hipps, Gillies, Wang, and Jin) have noted an increase in interest or request about climate science or climate change degree programs at USU. These professors are regularly probed by students with an interest in climate change and learning about how to obtain and apply such knowledge. The PSC academic advisor, Lisa Allen, has noted in the past two career affairs that students inquired for a Climate Science Degree at USU. This emergence of interest in climate and climate change is a welcoming sign that USU students are in-tune with this important global and societal issue. Their interest and inquries also reflect a new trend in academia: Institutions around the nation (and around the world) are either creating or expanding academic programs, research programs, and centers around climate and climate change sciences. The effect of these efforts will also attract faculty, students, and research funds.

Similar Programs

Currently, no similar programs in the area of climate and climate change sciences exist in Utah. Across USU, there also is not a single major or program that engages in the physical aspects of climate. However, as pointed out previously, some similar degree programs have recently emerged in the western U.S., mostly in the states of California and Washington. The University of Utah has a Department of Atmospheric Sciences that is focused on the meteorological training, weather forecasting, and physical or chemical properties of the atmosphere (e.g., microphysics); they did not offer climate prediction and climate change sciences. In recent years however, realizing the need for climate change research, the UU Atmospheric Sciences department recruited two faculty members specialized in large-scale climate dynamics. These two faculty have been in collaboration with USU climate faculty over the past five years. Thus, the proposed undergraduate degree in Climate Science will be the first in the Intermountain region.

Collaboration with and Impact on Other USHE Institutions

No collaborative proposals were developed with other USHE institutions. Each state is unique in its geography and demography, and this uniqueness translates into the different needs and focus of the state's citizen. The prime purpose of the Climate Science Degree program at USU is to serve Utah, providing its future students with state-of-the-art knowledge and comprehensive education in the emerging climate sciences. Therefore, the new program is not likely to impact other USHE institutions that serve their own unique purposes and audience. However, it is not anticipated that students of other USHE institutes who are interested in climate science to transfer to USU's Climate Science Degree program.

Benefits

The changing climate is a major scientific and social challenge that will dictate many career options and also demands particular technical skills. This program addresses the need to train students to understand, use, integrate, interpret and communicate disparate data to advance climate and climate change sciences – this is unique among all higher-education institutions across the state of Utah. Doing so will increase student interest and student enrollment in the area of climate science. The interdisciplinary research and education infrastructure of USU and PSC department can provide an additional working model for other USHE institutions to observe and adopt.

Consistency with Institutional Mission

The mission of USU is to be one of the nation's premier land-grant and space-grant universities by fostering the principle that academics come first, and by serving the public through learning, discovery, and engagement. The proposed degree program in Climate Science fits this mission and it will facilitate the emerging research themes across disciplines to study climate change impacts, such as sociology, ecology and agriculture. By establishing a BS degree in Climate Science, USU will show the nation and the world a vision to advancement and preparedness of humanity; doing so also fulfills the USU goal #9 "Communicate the success of the University to the world."

Section IV: Program and Student Assessment

Program Assessment

Evaluation and assessment will be assisted by the USU STE^{2}M Center in conjunction with the routine external reviews. Full evaluation of the Climate Science Degree program's effectiveness requires a comprehensive approach to ensure its goals are attained with regard to outcomes, processes, and their interactions. The CSD program will apply the so-called Kirkpatrick's 4-level model of evaluation, which separately examines student learning, transfer of skills in applied settings, stakeholder reactions, and broader outcomes. To assess program success, formative and summative data will be collected from program students and faculty, as well as individuals from outside the university with regular, formal student contact during and after their graduation. This degree can be either terminal or non-terminal, with the "climate dynamics" track (see page 21 the 3rd block of elective credits) more inclined to a non-terminal degree towards graduate schools in physical climate research and other tracks ready for employment.

a) Students. At each semester end, students will complete anonymous course evaluations and surveys eliciting opinions on the value of program learning experiences, the extent of skill development toward their professional goals, and facets of the program (courses, mentorship, research experiences, etc.) they find to be most and least helpful. Open-ended items will invite suggestions for concrete ways to improve the program in both the near and long terms. In addition to these survey elements, students receiving supervised lab-based research or conducting undergraduate research projects will complete brief scales of graduate advisement experiences and research experiences. Students participating in extra-academic internships will also complete research self-efficacy and access to research infrastructure subscales.

b) Faculty. The group of program faculty will meet once per semester with an evaluator to discuss their perspectives on the strengths and weaknesses of the program as implemented, with the goal of reaching consensus on approaches to refining the program to better meet its articulated goals. The USU STE^{2}M Center will serve as a facilitator during discussions to direct the focus toward concrete actions for the improvement of the program. The STE^{2}M Center will also interview faculty individually to follow up on concerns and ideas.

c) Direct Measures. Key indicators of program effectiveness are students' persistence and completion of the degree program (with particular attention to underrepresented groups), their abilities to contribute to substantive scientific advances, interpret findings from scholarly articles, and conducted research in their final semester. Additionally, students' ability to obtain employment in a climate-related capacity following completion of their degree will reflect the opinions of employers as to graduates' capacity to serve as professionals in climate forecasting or adaptation careers. The rate of Climate Science Degree program students in attaining these traditional markers of success will be compared against that of students from other, comparable programs within USU through collaboration with USU's Office of Accreditation, Analysis, and Assessment which keeps statistics on enrollment, retention, degree completion, time to degree, etc.

d) Professional Contacts. As students meet others in professional interactions (e.g., extra-academic experiences, internships), USU's Office of Accreditation, Analysis, and Assessment will contact their non-faculty supervisors to request the completion of a short comparative assessment of the students' skills, abilities, and knowledge base as reflected in their performance. This survey will ask about students' quality on both a criterion basis and in comparison to their previous encounters with students not from the Climate Science Degree program regarding readiness to solve important problems in the field through data analysis, scientific communication ability, and ability to engage productively as part of an interdisciplinary team.

Expected Standards of Performance

The B.S. in Climate Science will be thorough, intense, and rigorous. This will provide students with a solid grasp of all of the fundamentals in physical climate systems, and will also focus on general science concepts, mathematics, and data-analytical skills. In addition to developing scientific knowledge, bachelor's degree students must also build writing, communication and critical thinking skills. Learning assessment will take place at two levels of performance. At the level of the individual course or program element (e.g., suite of core courses), student performance on exams, papers, and other demonstrations of adequate performance will be compared against students from other PSC programs enrolled concurrently, as well as against pre-existing standards of academic performance. Faculty will use integrated forms of two previously validated rubrics to assess research quality for reports and proposals and a separate rubric to

assess the quality of scientific communication (from faculty/instructor feedback), in order to provide consistent performance-based assessment mechanisms and criteria across facets of the program.

The CSD students must be able to apply their knowledge to solve meaningful and challenging problems facing the field. To evaluate their progress, faculty will use the rubrics described above to assess research performance in supervised term paper settings after student completion of upper-level courses. Thus, program faculty will identify and evaluate students' use of specific skills and concepts taught earlier in the program as they complete later courses and mentored research opportunities to communicate as feedback to program participants and as part of formative evaluation. During faculty meetings or through semester-end interviews with the students, faculty will identify those skills that students successfully and unsuccessfully applied in new contexts, so that weaknesses in academic preparation can be remedied and successful practices leveraged more broadly throughout the program.

Section V: Finance

Department Budget

Three-Year Budget Projection							
Departmental Data	**Current Departmental Budget – Prior to New Program Implementation**	**Departmental Budget**					
		Year 1		**Year 2**		**Year 3**	
		Addition to Budget	**Total Budget**	**Addition to Budget**	**Total Budget**	**Addition to Budget**	**Total Budget**
Personnel Expense							
Salaries and Wages	$676,828	$55,158	$731,986	$0	$731,986	$0	$731,986
Benefits	$30,457	$2,482	$32,939	$0	$32,939	$0	$32,939
Total Personnel Expense	$707,285	$57,640	$764,925	$0	$764,925	$0	$764,925
Non-Personnel Expense							
Travel	$0	$0	$0	$0	$0	$0	$0
Capital	$0	$0	$0	$0	$0	$0	$0
Library	$0	$0	$0	$0	$0	$0	$0
Current Expense	$90,206	$0	$90,206	$0	$90,206	$0	$90,206
Total Non-Personnel Expense	$90,206	$0	$90,206	$0	$90,206	$0	$90,206
Total Expense ***(Personnel + Current)***	$797,491	$57,640	$855,131	$0	$855,131	$0	$855,131
Departmental Funding							

Appropriated Fund	$797,491		$855,131		$855,131		$855,131
Other:							
Special Legislative Appropriation							
Grants and Contracts	$5,587,562		$5,587,562		$5,587,562		$5,587,562
Special Fees / Differential Tuition							
Total Revenue	$797,491		$855,131		$855,131		$855,131

Difference							
Revenue-Expense	$0	$	$0	$	$0	$	$0
Departmental Instructional Cost / Student Credit Hour* *(as reported in institutional Cost Study for "current" and using the same Cost Study Definition for "projected")*	$374.40	$	$374.40	$	$374.40	$	$374.40

***Projected Instructional Cost/Student Credit Hour** data contained in this chart are to be used in the Third-Year Follow-Up Report and Cyclical Reviews required by R411.*

Funding Sources

To make this Climate Science BS possible, additional faculty are needed to teach courses not presently offered at USU. Two new faculty positions have been approved and are being recruited, to start in FY2016. These positions are earth systems modeling and dendroclimatology.

Cooperation with the National Central University in Taiwan: A novel part of this program is in the sharing of four core courses and six elective courses (see the program Curriculum) with the National Central University (NCU)'s Department of Atmospheric Sciences in Taiwan, located 30 miles south of the capital city Taipei. The USU President and the Dean of CAAS have signed the Student Exchange Agreement with the NCU counterpart. In these agreements (Appendix), students will be participating in an exchange program where USU students in their 3rd or 4th year will live in Taiwan and attend classes there, while only paying tuition at USU. The exchange will not affect department expenditures. Students not able to make the physical exchange possible will participate in shared courses via Interactive Video Conferencing (IVC) established by the USU Regional Campuses and Distance Education. These arrangements will be facilitated through USU's Association for Information System. The USU distance learning facility is scheduled to be installed at NCU in spring 2016.

Reallocation

No reallocation is proposed.

Impact on Existing Budgets

Minimal impacts are expected on existing budgets due to new faculty coming to the department in 2017 in dendroclimatology and and earth systems modeling. Program support such as advising and some teaching support will be managed by current staff and current operating budgets.

Section VI: Program Curriculum

All Program Courses (with New Courses in Bold)

Four required core courses and additional four ellective courses will be taught through Curriculum Exchange (Appendix) established between USU and the Department of Atmospheric Sciences, National Central University (NCU) in Taiwan. Agreements are being secured to enable USU students to travel to NCU for one year, taking these courses within two semesters. For those who do not or cannot travel, these NCU courses will be taught through distance education facility in a similar way of taking any USU online courses. An equal number of NCU students will come to USU for the same amount of time, taking any course offerred in the Climate Science Degree program curriculum, and interact with USU students.

Course Prefix and Number	Title	Credit Hours
Required Courses		
MATH 1210, 1220	Calculus I & Calculus II	8
MATH 2250	Linear Algebra and Differential Equations	4
MATH 2210	Multivariable Calculus	3
STAT 2000	Statistical Methods	3
PSC 2000	The Atmosphere and Weather	3
CHEM 1210	Principles of Chemistry	4
PSC 3000	Fundamentals of Soil Science	4
PHYS 2210	Physics for Scientists & Engineers I	4
WATS 3000	Oceanography	3
PSC NCU-R2	**Atmospheric Thermodynamics**	3
GEO 1110	Dynamic Earth-Physical Geology	3
PSC NCU-R1	**Atmospheric Instrumentation and Operation**	*4*
PSC NCU-R3	**Atmospheric Dynamics I**	*3*
PSC NCU-R4	**Atmospheric Physics**	*3*
PSC 5900	Boundary Layer Meteorology	3
PSC 5500	Land-Atmosphere Interactions	3
PSC 5003	Remote Sensing of Land Surfaces	4
PSC 5400 (new hire)	**General Meteorology**	3
GEO 5680	Paleoclimatology	3
POLS 4820	Natural Resources and Environmental Policy	3
PSC 5123	Climate Data Analyses	3
	Sub-Total	**77**

Course Prefix and Number	Title	Credit Hours
Elective Courses (take up to 7 credits of the following courses)		
JCOM 1130	Beginning Newswriting for the Mass Media	3
GEO 3100	Natural Disasters	3
ENVS 3600	Living with Wildlife	3
ECN 3170	Law and Economics	3
ENVS 5550	Sustainability: Concepts and Measurement	3
CEE 3610	Environmental Management	3
APEC 5560	Natural resources and environmental economics	3
WATS 4490	Small Watershed Hydrology	4
CEE 5940	Snow Hydrology	3
PSC 5270	Environmental Plant Physiology	2
CEE 3430	Engineering Hydrology	3
GEO 3200	The Earth Through Time	4
CS 3430	Computational Science: Python and Perl Programming	3
PSC 5000	Environmental Instrumentation	2
PSC NCU-E1	*MATLAB Programming and Application*	*3*
PSC NCU-E2	*Climatology & Monsoons*	*3*
PSC NCU-E3	*Boundary Meteorology*	*3*
PSC NCU-E4	*Air Pollution*	*3*
PSC 5670	Environmental Soil Physics	3
	Sub-Total	7
General Education + Capstone		32 + 4
	Sub-Total	**36**
Track/Options (if applicable)		
	Sub-Total	**n/a**
	Total Number of Credits	**120**

Example of Program

Admissions Requirements for this Program			
New freshmen	Admitted to USU in Good Standing	Transfer students from other institutions or other programs at USU	2.75 GPA

First Year

Fall Semester	Credits	General Education Info and Notes:	Spring Semester	Credits	General Education Info and Notes:
GEOG 1110: Physical Geology	3		CHEM 1110: General Chemistry (BPS)	4	
MATH 1210: Calculus I (QL)	4		PSC 2000: The Atmosphere and Weather	3	
ENGL 1010: Introduction to Writing: Academic Prose (CL1)	3		ENGL 2010: Intermediate Writing: Research Writing in a Persuasive Mode (CL2)	3	

SOC 1010: Introductory Sociology (BSS)	3		MATH 1220: Calculus II (QL)	4	
POLS 1100: United States Government and Politics	3		USU 1360: Climate Change on Earth	3	
Comments 16 credits			Comments 17 credits		

Second Year

Fall Semester	Credits	General Education Info and Notes:	Spring Semester	Credits	General Education Info and Notes:
WILD 2200: Ecology of Our Changing World (BLS)	3		PSC 4810: Climate and Climate Change (DSC/QI)	3	
Breadth Humanities (BHU) Course	3		GEO 3300: Geology of the World's Ocean	3	
PHYS 2210: Physics for Scientists and Engineers I (QI)	4		MATH 2210: Multivariable Calculus	3	
MATH 2250: Linear Algebra and Differential Equations (QI)	4		CHEM 1210: Principles of Chemistry	4	
PSC 3000: Fundamentals of Soil Science	3		WATS 3000: Oceanography	3	
Comments 17 credits			**Comments 16 credits**		

Third Year

Fall Semester	Credits	General Education Info and Notes:	Spring Semester	Credits	General Education Info and Notes:
PSC NCU-R2: Atmospheric Thermodynamics	3		GEO 5680: Paleoclimatology	3	
PSC NCU-R4: Atmospheric Physics	3		PSC 5003: Remote Sensing of Land Surfaces	4	
PSC 5400: General Meteorology	3		PSC 5270: Environmental Plant Physiology	3	
PSC NCU-R1: Atmospheric Instrumentation and Operation	4		PSC NCU-R3: Atmospheric Dynamics I	3	
Comments 14 credits			Comments 14 credits		

Fourth Year

Fall Semester	Credits	General Education Info and Notes:	Spring Semester	Credits	General Education Info and Notes:
PSC 5900: Boundary Layer Meteorology	3		Practicum	4	
PSC 5123: Climate Data Analyses	3		PSC NCU-E4: Air pollution	3	
PSC 5000: Environmental Instrumentation	4		POLS 4820: Natural Resources and Environmental Policy	3	

GEO 3100: Natural Disasters	**3**		PSC 5500: Land-Atmosphere Interactions	**3**	
Comments 13 credits			Comments 13 credits		

Section VII: Faculty

List of current faculty within the institution with their qualifications:

- Robert Gillies, Professor, PSC – Areas include remote sensing, meteorology, climatology
- Larry Hipps, Professor, PSC – Areas include air-land interaction, boundary layer meteorology, instrumentation
- Simon Wang, Associate Professor, PSC – Specialized in climate dynamics, synoptic meteorology, climate prediction
- Jiming Jin, Associate Professor, PSC/WATS – Areas cover hydroclimatology, regional climate modeling
- Scott Jones, Professor, PSC – Expert in soil physics, hydrological science, instrumentation
- Sarah Null, Assistant Professor, WATS – Areas include water resource management, climate change
- Patrick Belmont, Associate Professor, WATS – Specialized in watershed hydrology, sediment dynamics, geomorphology
- Beth Nelson, Associate Professor, CEE – Research in stream dynamics, climate change impact
- Tammy Rittenour, Associate Professor, GEOL – Specialized in paleoclimatology
- (New Hire 2016), PSC – Areas include tree-ring climatology, dendro-hydrology, climate variability
- (New Hire 2016), PSC – Areas are in the physical and computational sciences of climate dynamics
- (Potential New Hire 2017), PSC – Extension Climatologist